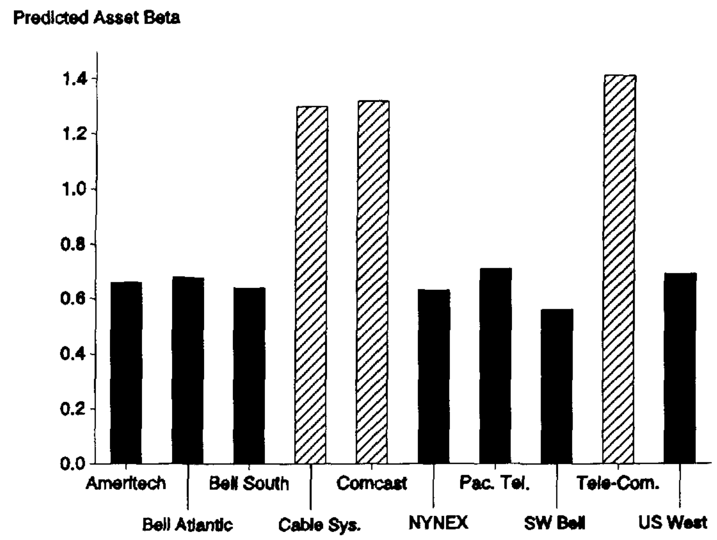
Chart 5
Cable vs. Telco Beta Factors - 1986



These yields and stock price variations reflect many factors. Discounted cash flow calculations of the cost of capital for telcos depend significantly upon financial market expectations that the telephone companies' dividends will be stable and their stock prices will appreciate slowly; whereas, as discussed, the cable industry is valued by its long-term cash flow, not its annual return on investment. Dividends in the cable industry are virtually unheard of. And operating factors, not just financial factors, would also have significant effects on a cable operator's "cost of capital" for ratesetting purposes. The same types of factors also drive other elements of the cable system's overall production function and thus would affect ratemaking and "revenue requirements" calculations in many ways other than the cost of capital.

The method and cost of regulation

Overall, we could identify still more differences between the cable and telephone industries based upon financial, operational, and even regulatory practices. Telephone companies have long been subject to uniform accounting rules that differentiated only the smallest industry participants from major companies, and the

FCC has many years of experience interpreting and refining accounting data. Such uniformity does not exist with cable operators, and factors such as varied capital funding and leverage; varied life-cycle stages of different systems; and varied franchise renewal and rebuild costs make uniform accounting in the telco sense almost impossible. Besides the traditional large-carrier, small-carrier accounting differential, the FCC has several other regulatory programs intended to group telephone carriers into as homogenous groups as possible, for ease of regulation. Of course, during the era of deregulation of cable no such policies were required or even considered.

Title II common carrier rate regulation imposes mainly broad requirements whose implementation has been left to the Commission for many years. Requirements concerning uniform accounts (USOA), depreciation prescriptions, "just and reasonable rates" and so on, have been outlined but the Commission can fully define these terms in practice. The Commission also has discretion to interpret the 1992 Cable Act but there are important differences. The 1992 Act contains many provisions that likely will affect the basic economics of cable operators' businesses, including retransmission consent, lbuy through prohibitions, equipment pricing, technical compatibility, unbundling rules, and so on. Unlike the historical *evolution* of telephone regulatory policies designed by the Commission, the Cable Act's effects will have *significant inter-active economic effects*. Most of these requirements have to be implemented essentially concurrently; even provisions of the Act that might not go into effect for a year impose essentially "real-time" impacts on cable system planning and economics.

All of these differences between the telco and cable regulatory regimes must shape the rate regulation plan determined by the Commission. While it is more than clear that a public utility type cost of service regime would be counterproductive in the cable industry, it is also fair to say that the literal system of "price caps" now applied to dominant telephone companies will not be appropriate for the cable industry. The cable industry is not a candidate for the telco price caps system, with its national average price index adjustments, limited set of "exogenous" adjustments and well-defined service baskets and bands. The Commission predicated the national average price caps plan on many of the uniform rules that it had developed under Title II:

> In the area of LEC costs, jurisdictional separations, usage, and earnings data, we currently monitor LEC performance using two reporting systems. The

> computerized ARMIS data base includes six reports of a wide range of operating information. Form 492 provides data focused primarily on the LEC's quarterly revenues and earnings. Based on our review of these reports and their contribution to price cap regulation, we conclude that these reports will adequately provide the information we will need to monitor price cap LECs. We generally deny requests by LECs that we reduce the amount of data they currently must file.[25]

In noting its ability to rely upon the large existing, historical data base of telephone company information, the Commission was reiterating its findings through the Price Caps proceeding.[26] The Commission also noted that:

> In the LEC Price Cap Order, we found that the rates in effect on July 1, 1990, as adjusted by subsequent errata, represented a reasonable basis from which to begin price cap regulation. Those rates were the product of an annual access review process, and represented the latest set of rates shaped by an ongoing rate of return review process dating back to 1984.[27]

Again, history presents the Commission with a different circumstance regarding regulation of basic cable rates. Neither the Commission, interested parties nor the industry have the comprehensive set of data upon which a telco-style price caps plan would have to rest. Accordingly, the correct balance between methods and costs of cable regulation will demand a different framework than either regulatory model applied to telephone companies.

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[25] *LEC Price Cap Order* (CC Docket No. 87-313) 5 FCC Rcd 6786 at paragraph 373 (1990)

[26] *See*, for example, the *Further Notice of Proposed Rulemaking*, 3 FCC Rcd at 3195 at paragraphs 118, 130-131 (1988).

[27] *Order on Reconsideration*, 6 FCC Rcd 2637 at paragraph 152 (1991), footnote omitted.

Conclusion

It is apparent that the economic attributes of the cable industry require a regulatory paradigm other than that used for the regulation of telephone companies. Over the last 20 years, many practices have developed in the cable industry that more closely resemble practices in competitive industries than in public utilities. The goal of an incentive regulatory plan for cable should be to preserve these competitive market analogues, while still providing the degree of price control and consumer protection required by the 1992 Act. Importing pre-existing regulatory concepts into cable rate regulation, even with the adoption of a telephone company-type "price caps" plan would eventually lead to *disincentive* effects without benefit to cable customers, the industry or those chartered with overseeing it.

APPENDIX D
FEDERAL COMMUNICATIONS COMMISSION
Docket No. MM 92-266

The Cost Structure for Converters, Outlets and Installation of Equipment

APPENDIX D
Federal Communications Commission
MM Docket Number 92-266

The Cost Structure for Converters, Outlets and Installation of Equipment[1]

Introduction

This paper describes a methodology for developing the directly attributable costs of equipment used with cable services.[2] As we demonstrate below, the methodology appears to resolve the significant ratemaking issues associated with cable-related equipment identified in the *Notice of Proposed Rulemaking*. The method provides a robust set of guidelines that can be applied to any equipment that is priced on an unbundled basis and, equally important, it can be used to establish threshold benchmarks for equipment components that might be priced in combination either with a basic service tier or with optional cable programming service tiers.

The Notice

At paragraph 63 of the *Notice*, the Commission proposes that cable equipment used for the basic service tier should be separate from the rates for the services themselves, and also separate from installations. The Commission notes that the 1992 Act's requirements regarding regulation of basic equipment rates based upon actual costs may or may not extend to other equipment used for cable programming service. The Commission notes that equipment may be designed to be used only with basic service, or equipment could be used to receive basic service, satellite tier services or individual channels provided to a specific converter address at a specific point in time. The Commission also notes that the cost requirements may extend to optional charges such as fees for additional outlets. *Notice*, paragraph 71.

At paragraphs 64-65 the Commission asks how to reconcile sections 623(b)(3) and 623(c) of the Act regarding equipment and other facilities used for different cable services. We show here that the same methodology can be applied to different types of equipment, outlets and the related installations. Equipment types range from the

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1 Prepared by W. Page Montgomery and Lee L. Selwyn, Senior Vice President and President, respectively, of Economics and Technology, Inc. Boston.

2 The methodology described here was developed and tested using cost and other data for Continental Cablevision, Inc. and in some instances was documented using Continental's specific chart of accounts. We believe however that the methodology is not sensitive to variations in accounting categories.

most simple set-top units to fully addressable converters; in the near future converters compatible with signal compression techniques will be utilized. The methods discussed here are compatible with cost analysis for this entire range of devices. Precisely how the resulting costs are applied, e.g., the extent if any to which these costs are bundled or unbundled with other services or devices, is a separate, *pricing decision*, however. The cost method provides information that can be used to *evaluate* pricing questions, and to provide a subsidiary check on the level of equipment prices that could be included in any non-basic rate benchmark.[3] But pricing can and should be distinguished from attribution of the underlying direct costs produced by this methodology.

At paragraph 66, the Commission proposes to require cable operators to calculate equipment prices based upon direct costs plus reasonable overhead loadings and profits. As we discuss below, the methodology we propose accurately identifies the directly attributable costs associated with the equipment, including the average level of profit for cable firms. This directly attributable cost can be factored up to account for general administrative or other costs, which are not calculated by this method.[4] The combination of these costs can be used to satisfy the "actual cost" test of §623(b)(3) of the 1992 Cable Act.[5] The direct costs are based upon a combination of using actual invoice prices for equipment, where feasible, and an overall distribution of costs associated with equipment and equipment installation; the method thus combines two

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[3] Thus, the equipment cost output could be utilized as a supplemental "cost cap", consistent with an overall benchmark system of regulation. The "cost cap" would be calculated using standardized factors and methods applicable to all systems. Then, the *lower* of the calculated cost or the operator's actual price for equipment, if the price is stated separately, would be reintegrated into more or more rate benchmarks using uniform, simple allocators. This combination of cost calculations and price regulation ensures that a benchmark approach to basic service is largely transparent to the equipment cost tests ultimately adopted by the Commission.

[4] Preliminary analysis suggests that a cable operator's overhead cost loadings would add between 5% and 10% to the directly attributable costs identified by this method. The Commission may find it appropriate to use this two-part cost approach, computing directly attributed costs and overheads separately, in order to simplify its review of cable operators' equipment rates.

[5] The cost results themselves also could simply become another benchmark. The approach could allow cable systems to price basic equipment and basic service together if appropriate. The cost method could be used only to evaluate the incremental charge permitted for optional equipment, like remote-capable converters, calculating only the differential costs of optional equipment without the cost of the equipment price that has already been picked up in the basic service.

of the methods discussed in footnote 95. Footnote 95 also mentions using a rate benchmark approach. Our method, applied to a sample of cable systems, should allow calculation of such benchmarks at far lower costs than full-blown rate base-type cost of service studies.[6]

Paragraphs 67 to 70 of the *Notice* raise a series of questions concerning how cost calculations should account for varying practices among operators regarding how installation costs are recovered, sales of equipment and the provision of additional house wiring. The methodology we propose here is essentially transparent to pricing practices, whether they are elected by individual operators or mandated by some future regulatory requirement. The methodology specifically allows, but does not require, a cable operator to recover installation charges by means other than a one-time fee or to establish equipment rental prices that account for sales to the consumer. As discussed below, the methodology differentiates between the expected life of the converter equipment itself and the expected "customer life," i.e., the average period in which the operator has the opportunity to amortize unrecovered installation costs, partial sales credits or other pricing mechanisms.[7]

The methodology discussed here also appears to resolve most of the points raised in paragraph 71 of the *Notice*. It differentiates between the installation costs associated with installing outlets for additional TVs (a) when the primary service is installed, (b) when a subsequent trip to the customers home is required, and (c) when additional outlets are merely upgraded or downgraded on site. The cost methodology does not attempt to isolate the costs associated "exclusively" with additional outlets, because identifying such costs would be quite complicated, requiring specialized engineering analyses of individual systems that would be difficult for the Commission to audit or verify. The proposed cost methodology identifies the costs of signal transmission requirements associated with *all* outlets (i.e., all primary and additional outlets utilized by subscribers) and then proportionately assigns the overall costs

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[6] Footnote 96 suggests that it might be appropriate to unbundle the costs of servicing equipment. We recommend that this proposal be deferred. Implementation of the 1992 Act already promises to entail major changes in many consumers' services, channel line-ups, rates and rate structures, and potential confusion that the Commission should not seek to exacerbate. Cable service calls may be incurred disproportionately by certain customer groups, such as the elderly or newer customers; pricing service calls separately could have effects on such groups that Congress did not contemplate.

[7] While the cost process may be used to set an upper limit on equipment costs, it is not intended to supplant normal market considerations used to set customer prices.

associated with additional outlets to the unit costs of these devices.[8]

Finally, the method described herein accommodates the Commission's interest in cost of service methods recognizing the cyclical character of cable investments and the various "rate base" treatments discussed in paragraphs 5 and 6, respectively, of Appendix B to the *Notice*. The cost method would use a levelized calculation of net undepreciated investments based upon the life or lives associated with the equipment and other devices and the carrying costs of this investment. The various types of converter equipment and cable outlets are relatively discrete investments that vary in proportion to the number of subscribers taking service. This methodology produces acceptable and consistent cost results when it is applied to these relatively discrete investments.[9] The same levelizing method, however, would not be appropriate if extrapolated to larger, "lumpier" investments in cable reception and distribution plant or even programming costs.[10]

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[8] Most cable operators install a primary outlet when the basic service hookup is placed in the subscribers' home. The costs of this activity are recovered in the same manner as the costs of installing the basic service and, as the Commission recognizes, different pricing plans such as promotional rates may be applied to the recovery of these costs. The methodology discussed here relates only to the incremental costs of installing a converter box (e.g., unpacking, testing, plugging in and providing the customer with use instruction) or an additional outlet in a different location in the home. Thus, this method is transparent to and fully compatible with, any ratesetting methodology adopted for basic service and installation, including a price benchmarking approach.

[9] In fact, the levelized net plant calculation likely understates to some degree the equipment costs confronted by a cable operator who, for example, faces demand for widescale conversion to more costly addressable converters. The levelized calculation discounts, in effect, the higher current costs incurred by such an operator in acquiring large numbers of new converter boxes, because it reflects average, historical life expectancies.

[10] Indeed, the sheer complexity and data required by the *relatively straightforward* converter equipment cost methodology may well lead one to conclude that a traditional cost of service analysis cannot be applied to cable services overall without engendering very significant transaction costs for the Commission, local authorities and cable operators. This result would be contrary to the 1992 Act's intent to reduce paperwork.

Directly Attributable Costs

The method for calculating directly attributable costs should produce the incremental costs for converters and additional outlets. These directly attributable costs can then be combined with any other relevant costs, such as administrative overhead or franchise costs, in several different ways. The best way to match costs with cost causation is to recover costs in the same manner as they are incurred. This approach properly avoids possible mis-matches or under-recovery of either the directly attributable or other types of costs, such as might be caused by different rates of customer churn in service(s), equipment types and additional outlets.

As discussed in Appendix _C_, the overall cost structures of specific cable systems vary quite significantly as a result of local factors, the lumpiness of capital additions in specific franchise areas, and the historical lag between cable system investments and revenues. These factors also apply to cable equipment to some degree. The development of this cost methodology requires several iterations to account for such variations in data and in the availability of data, because the attributable cost calculations must apply to multiple cable systems. The method ultimately used to calculate the costs reflects a balance among the generality of the method, the detail of the cost information, and the availability of data. Therefore, the cost methodology must allow for different levels of data aggregation depending on the circumstances of the operation. For example, property tax rates on converters or subscriber outlets may differ significantly from state to state or franchise to franchise; it would not be appropriate either to average the tax payments across jurisdictions or to assume that the tax basis always equates to the purchase prices of unit. Other costs such as miscellaneous materials and wiring must be averaged across different subscribers and may also be averaged across multiple systems or geographic areas. Only by achieving a balance can such a method meet Congress' goals of minimizing the additional burdens placed on cable operators, franchising authorities and the Commission.

The basic methodology used for both converters and cable outlets is quite similar to many discrete costing tools that have been submitted to the Commission, and utilized by Commission staff, to analyze costs for many types of services and equipment subject to rate regulation. The same general methodology has been used, for example, to support rates for regulated telephone equipment, including customer premises equipment which has since been deregulated, and equipment such as network channel terminating equipment (NCTE), which typically is still tariffed by telephone carriers. In fact, telephone NCTE is similar in some respects to a portion of the costs that should be attributed to individual subscriber outlets on the cable TV system. This general methodology is not, however, merely an established regulatory costing system. Many businesses use methods like this one to determine the costs of goods and/or services offered in nonregulated markets. In earlier years, time sharing computer systems were used by many firms to perform such cost calculations. Today such capabilities reside in simpler software for personal computers and can be developed using generic software packages like spreadsheets.

Capital costs and capital cost recovery

Any of these cost analysis tools follows the same general format. Costs are identified as either capital costs or expenses. Capital costs are recovered over some estimated life period, while expenses are recovered immediately. Some costs may be treated either as capital items or expenses depending on how the costs are incurred within the overall production function of the cable operator. The operator who wishes not to create an economic barrier for potential new subscribers may choose to capitalize some of the costs associated with installation, including labor costs. Labor costs incurred as part of repairs, maintenance and other activities of a recurring but episodic nature (with respect to which subscribers require these activities) may be expensed.[11]

Capital cost recovery may occur over several different time periods of life cycles. In the cable TV business, one may identify as many as three to five arguably different life cycle periods. However, each additional life cycle used in the cost methodology will increase the complexity of the cost process significantly, and would increase the burden of rate regulation. Substantial review of many different life estimates by actual cable systems indicates that two types of time periods need to be used. The "*customer life*" is the average time during which a single subscriber may use equipment, and the "*converter life*" represents the average expected economic life of the devices themselves, including subsequent reuse of the same device in a different

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[11] Again, the identification and treatment of the costs is not necessarily indicative of pricing practices. Some subscribers may require much more maintenance than others, but whether to charge those particular subscribers for routine maintenance visits (thereby incurring an additional billing cost) or simply to recover those costs from all subscribers, is a pricing decision that must be distinguished from how the costs are defined or captured in the costing process.

location. These two lives accurately capture the nature of the cable business and the number of combinations of services and equipment available to a subscriber, creating the least complex approach to the analysis consistent with meaningful and accurate results.[12] Each of these estimates will be used to amortize different parts of the equipment cost function, and can be specified by the cable operator to reflect differing local conditions.[13]

First costs of capital. The basic capital costs of acquiring units of plant or equipment from manufacturers or distributors represent that initial capital cost. These first costs are best defined as the current costs of equipment that is most comparable to the devices being costed (e.g., "non-addressable set-top converters") at the point such as a warehouse from which the units are supplied to customers. These first costs include: (a) the purchase costs of equipment, reflecting any discounts; (b) sales taxes; and (c) freight and other handling charges at the warehouse (such as affixing channel listings stickers or ownership labels to the converter boxes).

Converter costs can be grouped into four possible types: a) Non-addressable set-top converters; b) Addressable set-top converters; c) Non-addressable remote converters; and d) Addressable remote converters. This breakdown generally typifies the basic categories of converters in use today, but it may be adjusted to reflect local market factors. The classification does not mean, however, that each system is able to, or should, provide data for each type of converter. Only one or two types may be utilized in any given system.

Remote control devices. Devices capable of remote control usually consist of two physical units: The converter box, which has the ability to respond to user signals, and the hand-held signalling devices themselves. Some confusion seems to exist concerning what the cable operators' "remote" charges actually encompass. Some

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12 The cable systems analyzed during the development of this method appeared to be able to differentiate these two time periods easily and to establish their values clearly. Other potential "life cycles" covering discrete types of converters or outlets of other service functions complicated the process, confused the operators, and, as a result, failed to improve the precision of the cost method.

13 As discussed below, some system-related (i.e., outside the home) costs are properly associated with outlets in the home. Local variability in the expected lives of system related components is much less likely and is closely related to the depreciation life or franchise period Hence the system-related costs that are attributed to subscriber outlets are to be amortized over the same period used for depreciation of distribution plant.

subscribers believe that the remote charge only covers the hand-held unit. However, almost all "remote" converters have computer chips that enable the remote feature as well as addressability. Therefore, manufacturer prices for the converter units themselves are frequently twice as great as charges for feature-less boxes. The manufacturer's price for these "remote" converters usually includes the hand held unit. Initially, the two units are shipped together by the manufacturers[14] and unbundled pricing usually is not offered. In the methodology we propose, the remote capability in the converter box itself would be recovered from the converter rental fee. The hand-held unit would not be costed out separately from the associated converter unit. The price for a hand-held unit would be established residually, so that subscribers would no longer confuse the "remote" charge as covering just a simple handset.

This approach simplifies the cost attribution process. Costing the hand set separately would require that a "first cost" be imputed to these units because representative manufacturer prices would not be available for all types of units. The cost recovery period for the handsets also would be different from either the customer or converter life; as most TV viewers know, remote control devices are susceptible to being broken or misplaced. Indeed, due to customer demand for replacement handsets, a number of cable operators must depreciate their investment in these devices over *shorter* lives compared to the converter units themselves. In our proposed regime, if a customer wished to have the cable operator replace a handset, that unit would be expensed. But the customer would remain free, as today, to acquire another type of handset (perhaps a "universal" remote device) without the cable company's involvement. Because the major cost of remote capability is correctly attributed to the rental fee for the remote-capable converter itself, the cable company's price for the hand-held unit, if any, would not be subject to separate cost calculations.

Most remote control devices can be replaced by numerous models of programmable devices available at most electronics stores, and most cable operators will replace hand held units for a nominal fee if a subscriber so requests. Therefore, while no separate direct cost is identified for handsets, both marketplace forces and

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[14] Replacement handsets, of course, may be acquired from a converter manufacturer separately. Virtually every remote control consumer electronics product comes with its own hand-held remote unit in the same package. Thus, even if a customer has or subsequently acquires a "universal" programmable unit, he or she is still required "buy" the unit supplied by the equipment. The cost method we propose treats the hand held remote for a cable converter in exactly the same way.

simple FCC surveys of cable operators' "remote" fees (without regard to cost analysis) ought to be sufficient to protect consumers. And, because the proposed methodology would ignore the cost factors that may uniquely affect the hand-held unit (such as its much shorter life expectancy), this treatment of the remote handset understates somewhat the costs actually faced by the operator.

Additional outlets - system capital costs, maintenance and system power. Costs for additional outlets present a different functional relationship than costs for converters of various types and therefore must be costed out separately. The primary difference between additional outlets and other equipment is that additional outlets require an operator to incur distribution system costs as well as costs within the subscriber's premises. That is, a hypothetically "pure" distribution system designed to support only one outlet per home passed would exhibit significantly different cost characteristics than a system engineered for additional outlets. These other costs are associated with the type, mix and number of active electronics devices, such as line extenders and trunk amplifiers, that must be placed in the distribution plant in order to provide signals of sufficient strength to all customers and all outlets on the system.[15]

Fairness to the single-set, basic service subscribers as well as cost causation indicate that the system-related, active electronics costs related to outlets deserve different treatment than the stand-alone costs of a typical converter installation. If these system electronics costs were not attributed to the number of revenue producing outlets, as they are in the methodology we recommend, most of the cost value would have to be treated as a "joint and common" cost. Because basic service users *are* required to bear some portion of the joint and common costs, the alternative treatment will necessarily raise basic service rates over time. However, basic service subscribers *are not* required to wire their homes with second, third or even fourth outlets, and many of them do not. Additional outlets are likely to be more useful to customers who have multiple television sets, multiple potential viewers and, in all probability, greater than average interest in viewing video programs. Attributing the outlet-related system electronics costs to charges for additional outlets is an

[15] Typically incremental distribution system electronics sufficient to accommodate an additional 4.5 dbmv of signal output level would be engineered in order to accommodate expected levels of multiple outlets per subscriber. Engineering estimates provided to us suggested that the incremental costs increases would range from 20% for trunk amplifiers, to 33% for line extenders up to possibility 50% of the cost to power the devices, or somewhat over $1200 per mile of distribution plant.

appropriate means of maintaining lower basic rates.[16]

Thus, the equipment-related cost calculations should account for the added system plant costs associated with additional outlets, as well as the costs required to compensate for increased system power requirements. Two methods for making this calculation can be labelled the "attribution" method and the "incremental engineering" method. As discussed below, the "incremental engineering" method represents the most precise way to reflect the costs attributable to additional outlets, because it is system-specific. Unfortunately, for the same reason the "incremental engineering" method is costly to apply and may not be suitable for regulatory purposes. Hence the methodology we recommend is the attribution method.

The attribution method requires that the operator segregate the unit costs of devices like line extenders, amplifiers and other active electronics costs from non-active plant assets. Non-active system plant includes cabling, supporting structures, cabling-related installation labor and investment in passive devices like taps, as well as devices such as couplers, connectors, equalizers and splitters. The resulting value should include total investment in active electronics as well as capitalized labor associated with splicing electronics. Then, the investment in the active electronics is divided by the total number of outlets in service, including both first and additional outlets. The resulting average unit cost per outlet is then added to the direct costs of the additional outlet device itself (i.e., the in-home portion) and other components like wiring and installation costs (net of costs offset by installation revenues). The same attribution technique extends to calculating expenses related to the maintenance and system power requirements presented by active electronics. These costs are identified and then pro rated to additional outlets based on total outlets.

The alternative method, i.e., attributing the system electronics costs required by additional outlets based upon calculations of engineering design costs, is much less practical and, we believe, less likely to be accepted by regulators.[17] It would require

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16 This method also is preferable strictly from a regulatory policy standpoint because it reduces the sensitivity of service rates to the amount of "joint and common costs." That is, whether one uses a price benchmark approach or cost of service regulation, it is always preferable to minimize the proportion of the "joint and common" costs because allocations thereof are essentially arbitrary, by definition.

17 Moreover, the dynamic technology in cable television makes this calculation difficult, because system rebuilds using different technologies are likely to have significant effects on the short-run

(continued...)

an operator to either perform its own analysis using a computer-assisted design (CAD) system in order to identify additional outlet incremental capital costs designed into the system, or would require multiple cost estimates generated by each manufacturer. Many cable systems do not have the expertise to utilize a CAD system[18] and manufacturers themselves would be hard-pressed to generate the number of incremental cost estimates required to account for thousands of possible distribution system parameters. In addition, the CAD system could be viewed by some regulators as a "black box," i.e., a cost development tool that the regulator would have some difficulty understanding or replicating.

In contrast, the attribution method described above is based upon direct book values of active plant which can be extracted from balance sheets or other asset statements. Engineering analyses conducted by Continental Cablevision indicate that the attribution method on average produces direct cost results similar to specific engineering studies within a range of parameters that are typical of many cable systems.[19] This method, moreover, is believed to be less sensitive to changes in the system cost structure that may occur with a fiber rebuild, because cost data are being averaged over the larger base consisting of both primary and additional outlets. Both methods are consistent with incremental cost concepts. The one recommended here is consistent with a long run incremental cost, while this additional outlet-only cost would more closely resemble a short run cost.

Expenses associated with active system electronics. The active electronics that are placed in the distribution plant to serve the outlets also must be powered. The system power expense attributed to the additional outlets likewise represents the allocable portion of the total system power expense consumed by active electronics, divided by the total number of subscriber outlets in service, both primary and

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[17](...continued)
incremental costs of serving additional outlets (e.g., they are more expensive to serve on 550 Mhz coaxial systems compared to prior technology) but less impact upon the overall costs that can be attributed to all outlets.

[18] CAD systems may be used to initially design the cable plant prior to construction or for major rebuilds, but are not an everyday tool.

[19] Comparable results, with very little net impact on the overall costs attributed to additional outlets, occur where the total active electronics plant investment is 30% or less, additional outlet penetration is approximately 25% to 45% and the engineered cost differential is 10% or more.

additional outlets in the home.[20]

Other capital costs. The capital costs for items discussed above also must reflect other costs. Costs associated with spare converter equipment inventory are capitalized as a percentage of the first costs of the types of equipment installed on subscriber premises. Outlet devices require jacks and miscellaneous materials that are considered customer connection inventory. Capitalized costs associated with installation labor and materials should be included, as well as the discounted costs of removal of service, net of any estimated installation revenue received.

Capital carrying charge factors: Return, income taxes and depreciation. The direct capital carrying costs will be expressed as a return and income tax (RIT) factor that reflects (a) the cost of money (debt and equity), grossed up to account for federal income taxes payable at the marginal rate on earnings and, if applicable, similar state income tax rates. A net plant factor (NPF) is required in order to develop an effective rate of return on the investment in equipment. The return and associated income taxes are earned on the basis of the net depreciated investment, rather than on the gross undepreciated investment. The net plant factor is thus used to express an average relationship of net book costs to gross book costs because return is to be earned on the basis of net depreciated investment, rather than the gross investment. The net plant factor produces an estimate of average levelized depreciated investment over the service life of the equipment under examination. Over its revenue-producing life the value of the net investment will be declining, ultimately to the salvage value, which is usually zero. An historical factor may be appropriate in the context of an embedded cost analysis, but it is inappropriate for use in a forward-looking cost study.

Any alternative to some sort of net plant factor would require that either the size of the monthly payment be varied over the life of the equipment, or that the straight-

[20] The alternative means of allocating this expense would utilize the same type of calculation that would be required to identify investment dedicated to the incremental active electronics supporting the total potential capacity for additional outlets. This method likewise would require a CAD program or some other type of separate study process that would make the method difficult to apply in practice. Besides relying on specific engineering studies, the power expenses derived by means of this method would have to be factored up in order to distribute the costs associated with the nominal capacity of the system to the smaller number of additional outlets actually in revenue producing service. Thus, this method requires more data estimates, special studies and other calculations that are not required by the methodology we have developed here.

line method of depreciation be abandoned in favor of a more complex amortization schedule. The historical factor is the result of a number of forces, many of which have no relevance in a forward-looking cost study. The factor applied here thus provides an "equated capital charge" which permits both the monthly rate and the monthly depreciation charge to be levelized throughout the life of the asset.

Under straight-line depreciation, the average net depreciated investment, assuming zero salvage value will be exactly half of the gross investment, irrespective of the number of years over which that investment is depreciated. In the absence of any consideration of the time value of money, the use of a 50% net plant factor would fully satisfy the underlying objective of translating the gross investment into average net investment so that a uniform amount of return can be applied throughout the service life of the equipment. Under these specialized conditions, the amounts of the under-recovery and over-recovery will exactly equal each other if a NPF of 50% is used.

However, since we do not live in an interest-free world, the time value of money does enter into consideration, and the 50% figure is, in effect, a lower limit for an appropriately determined NPF. If a 50% net plant factor were used, then the present value of the over-recovery will fall below the present value of the under-recovery in the early years and will, therefore, be insufficient to offset the under-recovery of authorized return on net investment in the early years of the life of the asset. Therefore, the NPF must be increased to compensate for the lower present value of the ultimate over-recovery in the later years of the investment. Similarly, as the number of years over which the investment must be recovered increases, a higher NPF is needed in order to bring the present value of the under- and over-recovery into equality. The calculation which will determine the appropriate NPF on the basis of the interest rate and the life of the investment is:

$$NPF = \frac{\displaystyle\sum_{i=1}^{M} \frac{rG(1-\frac{i-\frac{1}{2}}{M})}{(1+r)^i}}{\displaystyle\sum_{i=1}^{M} \frac{rG}{(1+r)^i}}$$

where M = Service Life in Months
r = Monthly Rate of Return (r = Annual rate / 12)
G = Gross Investment
NPF = Theoretical Net Plant Factor

The formula creates a table of theoretical net plant factors that can be generated for various interest rates and investment lives in order to produce equality of the present values of the early under-recovery and later over-recovery of the return on net investment.

The actual or historical NPF is determined by more than the mean service life and the rate of return. All other things being equal, the actual net plant factor will be higher under conditions of greater growth, of premature retirement of equipment which is not fully depreciated, of rapid obsolescence of plant and replacement with new equipment, and of greater inflation. However, factors such as growth, retirements, inflation and technological obsolescence are not included in the development of the levelized net plant factor.

These factors must still be accounted for. For example, the question of technological obsolescence should be addressed in the service life ascribed to the equipment in question. If more rapid obsolescence is anticipated, this fact should enter into the determination of the service life. The interest rate and the service life of the operator's plant will have a direct effect on the table of NPF values. Prospective growth and inflation have a less direct bearing on the determination of capital-related costs for individual units of equipment to be furnished to individual customers, but both do affect the interest rate used in determining the necessary cash flow. Therefore, these factors should be reflected in the rate of return used to determine the annual return and income tax (RIT) factor.

Other Expenses

Operating expenses. Maintenance and repair costs are expensed. Repair costs on manufacturer-warranty equipment include all expenses, such as shipping and handling or "cosmetic" repairs, that are not reimbursed under the warranty, to the extent these costs can be identified from the cable operators books and records. The costs related to the theft of equipment is treated as a non-capital item, fully recoverable in the year of acquisition, based upon the cost of replacement equipment as offered by manufacturer(s).[21]

Other taxes. Other taxes such as local income taxes and gross receipts taxes will be added locally. Methods of levying local property taxes or other *ad valorem* levies may include net book value, replacement costs, some basis negotiated with a taxing or franchising authority, revenue-based methods and others. Different types of property tax exemptions also apply in different jurisdictions. In order to account for many of these variations, property taxes can be computed using different types of data. The *basis method* calculates property taxes using two input values: The tax basis (in dollars and cents) and the tax rate. The *composite method* computes the total size of property tax payments and divides that value by the units of plant covered by elements of the tax, such as converters, active electronics and home wiring, etc.

Other unit charges should reflect other types of identifiable, direct expenses such as sales commissions.

Inside wiring. Costs attributable to wiring beyond the ground block assembly[22] will be attributed to equipment and additional outlet costs, but the company-average

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[21] An alternative accounting procedure is to expense only the difference between purchase price of replacement equipment and average remaining net book value of the stolen equipment. However, the expensing method described here can be applied more consistently because it relies upon two data items (1) theft and other shrinkage of equipment stocks and (2) the purchase price of equipment acquired to replace lost or stolen devices. Equally important, expensing these replacement costs is more consistent with the levelized net plant factor applied to capitalized items. Because the levelized factor is designed to avoid having to allocate a depreciation reserve to each type of equipment, using the remaining book value of lost equipment, under the alternative accounting procedures, would require greater data collection efforts with little gain in precision.

[22] The term "assembly" includes any enclosure located on or at the subscriber premises used for traps, security, etc. These assemblies are not considered to be part of inside wiring.

estimate of the wiring associated with a single-outlet installation is attributed to the first outlet's cost which may be subsumed in charges for installing a basic service and a tier of satellite services. Then, the incremental costs incurred after the primary outlet are attributed to additional outlets. This method should be consistent with both customer expectations and the public policy favoring relatively low basic service rates.

Labor costs and activity times. Fully loaded hourly labor costs developed for different work categories should represent the full economic cost of a unit of productive work force labor, so it will be loaded for vacations, training, sickness and other non-productive time as well as for supervisory time, insurance, pension and other costs. Labor time estimates used in this model should reflect the operator's best estimates of time used for the overall transaction, including, for example, travel time and downtime in the case of an additional outlet installed on a separate trip. Different estimates of the time consumed by different activities of field service technicians should be developed in order to make the model as cost-oriented as possible. These different categories reflect the complexity of different types of jobs performed in the customer's home as well as whether or not travel is required.[23]

Customer service representative work times per transaction should be specified similarly so as to include idle time, breaks, etc. However, the work time and activity associated with telephone service personnel is more homogenous than the tasks assigned to field technicians. Customer service representative (CSR) times can be more broadly averaged without distorting costs properly attributable to installation and related activity. Therefore, only one CSR time is used is needed to accurately track costs; the CSR costs per hour should include the direct supervisory and management loadings as indicated above.

Pricing data. All pricing data used to offset costs developed by these devices should reflect the *average effective rates*, which are not necessarily the maximum retail rate shown on the operator's rate card. This is because the rate card does not reflect revenue reductions caused by promotions, free services and other discounts. Installation charges, in particular, are discounted or waived frequently, as the *Notice*

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[23] The installation costs that are capitalized with respect to converters, for example, represent only the *incremental* time attributable to the installation of converters themselves, and not the time required to install the primary house wiring or additional outlet wiring. The converter work time includes unpacking the device, attaching jumper wires from the outlet, simple testing of the converter and, significantly, the time required to instruct the customer in the use of a converter with his or her TV set.

indicates. Because an important element in the attribution of, say, installation *costs* is the amount of actual costs not recovered by installation *fees*, use of the nominal rate card prices could seriously distort installation costs which should be capitalized and allocated properly to converters and to additional outlets.

Conclusion

The methodology we have discussed above reflects a significant amount of study concerning the cost structure associated with converters, outlets and related functions. We have attempted to achieve a balance between the degree of detail needed to accurately reflect certain elements of the cost structure and the need for a cost method that can draw upon readily available data. The resulting product appears to comport fully with the requirements of the 1992 Cable Act. Equally important, the cost process can be applied individually to items of equipment that the Commission determines should be unbundled as well as being used to establish a "cost cap" for equipment combined with other rate benchmarks.

APPENDIX E
FEDERAL COMMUNICATIONS COMMISSION
Docket No. MM 92-266

Statement of Archer Taylor, P.E., Regarding Methods for Computing the Proportion of Distribution Plant Cost Attributable to Additional Outlets

Comments Regarding Methods for Computing the Proportion of Distribution Plant Cost Attributable to Additional Outlets

The incremental cost (investment) in distribution plant that is attributable to additional outlets has the following characteristics:

1. The incremental cost (in dollars) is almost completely independent of the number of subscribers or the number of additional outlets. The distribution plant must be designed with the capability of providing additional outlets at any or all tap ports. There is some relatively minor variability depending on the linear density of passings.

2. The incremental cost (in dollars) is due almost entirely to the increased cost of active electronics needed to provide additional signal power for the additional outlets. The incremental cost may be reduced somewhat by using lower loss cable instead of additional amplification, where technically feasible. The labor of splicing and balancing active devices should be included as part of the electronic component cost. With these minor adjustments, the incremental cost can be considered, for practical purposes, to be dependent primarily on the incremental cost of the active electronic component. Moreover, the electronic component cost is about the same for underground and aerial plant.

Estimation based on experience, rather than detailed analysis of typical designs, suggests a high probability that the incremental cost attributable to additional outlets will be between 20 and 30 percent of the total cost of the active electronic components. It may reasonably be assumed that up to 1/3 of the line extender cost, not more than 1/5 of the trunk amplifier cost, and perhaps 1/4 to 1/2 of the power supply cost are attributable to providing additional outlets capability. These assumptions yield an incremental cost of about 25 percent of an estimated total electronic component cost of $4500 per mile. Until a more detailed analysis of actual system design has been performed, 25 ± 5 percent would appear to represent a reasonable estimate.

In order to avoid the need to estimate the proportion of electronic component cost attributable to additional outlets, it has been suggested that the incremental cost could be approximated by multiplying the total electronic component cost by the ratio between the number of additional outlets and the total number of outlets (including the additional outlets). Each of these numbers is typically available from records without estimation. For the particular case in which the number of additional outlets equals 25 percent of the total outlet count, the two methods give identical results.

The following analysis is presented to indicate the effect of other circumstances.

Let:

E = Total active electronic component cost (dollars)
I = Incremental cost attributable to additional outlets
N_s = Basic subscriber count = number of first outlets
N_a = Number of additional outlets.
$N_s + N_a$ = Total number of outlets
R = Average number of additional outlets per subscriber
$R = N_a/N_s$

$$I = E * N_a/(N_a + N_s) = E * R/(R + 1)$$

The following table shows the values of $R/(R + 1)$:

R	R/(R + 1)
0.10	0.091
0.20	0.167
0.25	0.200
0.30	0.231
0.333	0.250
0.40	0.286
0.43	0.300
0.50	0.333
0.60	0.375
0.80	0.444
1.00	0.500

The approximate method yields comparable results for ratios R = 0.25 to 0.43. For lower ratios, the incremental cost is too low; for higher ratios, too high. Actually this range of values for R probably includes a great majority of all systems. (See graph attached)